Numerical simulation of the response of substrate traps to a voltage applied to the gate of a gallium arsenide field effect transistor

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A b s t r a c t

Wereportonanumericalsimulationoftheresponseofsubstratetrapstoavoltage appliedtothegateofagalliumarsenidefieldeffecttransistor(GaAsFET)using proprietary simulationsoftware.Thesubstrateisassumedtocontainshallowacceptors compensatedbydeeplevels.Theratiobetweenthedensitiesofdeepandshallowlevelsis consideredtobeonehundred,whichisatypicalvalueforsemi-insulatingsubstrates. Althoughseveraltrapsmaybepresentinthesubstratebutonlythemostcommonly observedonesareconsidered,namelyholetrapsrelatedtoCuandCr,andthefamiliar native electrontrapEL2.Thecurrent–voltagecharacteristicsoftheGaAsFETarecalculated in theabsenceaswellasinthepresenceoftheabovementionedtraps.Itwasfoundthat the holetrapsareaffectedbythegatevoltagewhiletheelectrontrapisnot.Thiseffecton the responseofholetrapsisexplainedbythefactthatthequasi-holeFermilevelinthe substrateisdependentonthegatevoltage.However,theelectronquasi-Fermilevelinthe substrateisinsensitivetothegatevoltageandthereforeelectrontrapsarenotperturbed.

Keywords:

Substratetraps Gate voltage GaAs MESFET SILVACOsimulation